U.S. FISH AND WILDLIFE SERVICE SPECIES ASSESSMENT AND LISTING PRIORITY ASSIGNMENT FORM

Scientific Name:

Chamaesyce deltoidea ssp. pinetorum

Common Name:

pineland sandmat

Lead region:

Region 4 (Southeast Region)

Information current as of:

04/07/2010

Status/Action

___ Funding provided for a proposed rule. Assessment not updated.

___ Species Assessment - determined species did not meet the definition of the endangered or threatened under the Act and, therefore, was not elevated to the Candidate status.

___ New Candidate

_X_ Continuing Candidate

___ Candidate Removal

___ Taxon is more abundant or widespread than previously believed or not subject

___ Taxon not subject to the degree of threats sufficient to warrant issuance of

___ Range is no longer a U.S. territory

___ Insufficient information exists on biological vulnerability and threats to s

___ Taxon mistakenly included in past notice of review

___ Taxon does not meet the definition of "species"

___ Taxon believed to be extinct

___ Conservation efforts have removed or reduced threats

Petition Information

___ Non-Petitioned

_X_ Petitioned - Date petition received: 05/11/2004

90-Day Positive:05/11/2005

12 Month Positive:05/11/2005

Did the Petition request a reclassification? **No**

For Petitioned Candidate species:

Is the listing warranted(if yes, see summary threats below) **Yes**

To Date, has publication of the proposal to list been precluded by other higher priority listing? **Yes**

Explanation of why precluded:

Higher priority listing actions, including court-approved settlements, court-ordered and statutory deadlines for petition findings and listing determinations, emergency listing determinations, and responses to litigation, continue to preclude the proposed and final listing rules for this species. We continue to monitor populations and will change its status or implement an emergency listing if necessary. The Progress on Revising the Lists section of the current CNOR (http://endangered.fws.gov/) provides information on listing actions taken during the last 12 months.

Historical States/Territories/Countries of Occurrence:

- **States/US Territories**: Florida
- **US Counties**: Miami-Dade, FL
- **Countries**:Country information not available

Current States/Counties/Territories/Countries of Occurrence:

- **States/US Territories**: Florida
- **US Counties**: Miami-Dade, FL
- **Countries**:Country information not available

Land Ownership:

Varied, see Table 1. There are 20 extant occurrences, 9 of which are on public conservation lands owned by Miami-Dade County and the National Park Service (NPS). Total acreages are not known.

Lead Region Contact:

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Biological Information

Species Description:

Bradley and Gann (1999, p. 24) provided the following description, “C. deltoidea ssp. pinetorum is an ascending to erect perennial herb forming small tufts. Stems villous, often reddish; leaf blades reniform or deltoid to orbicular or ovate, villous; involucres 1 mm [millimeter] long, pubescent; glands green; gland appendages very narrow, even-edged; capsules 2 mm broad, pubescent; seed 1 mm long, transversely wrinkled, yellowish (Adapted from Small 1993).”

Reproduction is sexual, but little is known about this taxon’s reproductive biology and ecology (Bradley and Gann 1999, p. 25). The pineland sandmat’s extensive root system indicates that it is a long-lived plant (Wendelberger 2003, p. 179). Pollinators are unknown; some congeneric species are completely reliant on insects for pollination and seed production while others are self-pollinating (Wendelberger 2003, p. 179). Pollinators may include bees, flies, ants, and wasps (Ehrenfeld 1979, p. 95). Dispersal is unknown for pineland sandmat; however, many seed capsules of Euphorbiaceae are explosively dehiscent, a form of dispersal that flings seeds far from the parent plant (Wendelberger 2003, p. 179). This species is known to fruit year round (Wendelberger and Maschinski 2006, p. 2). Fairchild Tropical Botanic Garden (FTBG) has found a peak in fruiting in the fall and stimulation after fire (Wendelberger and Maschinski 2006, p. 2).

Taxonomy:

Bradley and Gann (1999, p. 24) provided a complete history of the taxonomy: “C. deltoidea was first described by Small (1905) as C. pinetorum for plants collected by him in ‘pinelands between Cutler and Camp Longview’ in 1903. Small recognized that it was closely related to Chamaesyce deltoidea, which is now known from further north on the Miami Rock Ridge. Burch (1966) in a study of Caribbean Chamaesyce, retained the use of C. pinetorum. Some workers do not consider Chamaesyce to be a distinct genus in the very diverse Euphorbiaceae. In 1989, Oudejans published this taxon under the genus Euphorbia. Unfortunately, the name Euphorbia pinetorum was already in use for another taxon, so he produced the new name Euphorbia smallii. Other authors (Herndon 1993, Wunderlin 1998) have retained the use of the genus Chamaesyce. In a 1993 study, Herndon included this taxon within the C. deltoidea complex composed of three other taxa, two occurring further north on the Miami Rock Ridge, and one occurring on Big Pine Key in the Florida Keys (Monroe County). The three taxa on the Miami Rock Ridge have distinct ranges which abut each other. Herndon placed all four taxa at the same taxonomic level, treating each as a distinct subspecies, treating this taxon as C. deltoidea ssp. pinetorum. C. deltoidea ssp. adhaerens occurs immediately to the north of it, and C. deltoidea ssp. deltoidea occurs to the north of var. adhaerens. Wunderlin (1998) follows Herndon’s treatment in using C. deltoidea ssp. pinetorum.”

The Integrated Taxonomic Information System (ITIS) (2011, p. 1) indicates that the taxonomic standing for Chamaesyce deltoidea ssp. pinetorum (Small) Herndon is accepted. ITIS (2011, p. 1) gives Chamaesyce pinetorum Small and Euphorbia smallii Oudejans as synonyms. The online Atlas of Florida Vascular Plants (Wunderlin and Hansen 2008, p. 1) uses the name C. deltoidea ssp. pinetorum as does NatureServe (2010, p. 1). The Florida Department of Agriculture and Consumer Services (FDACS) uses the name Chamaesyce deltoidea, consisting of four subspecies, including ssp. pinetorum (Coile and Garland 2003, p. 11). In summary, there is consensus that C. deltoidea ssp. pinetorum is a distinct taxon. We have carefully reviewed the available taxonomic information to reach the conclusion that the subspecies is a valid taxon.

Habitat/Life History:

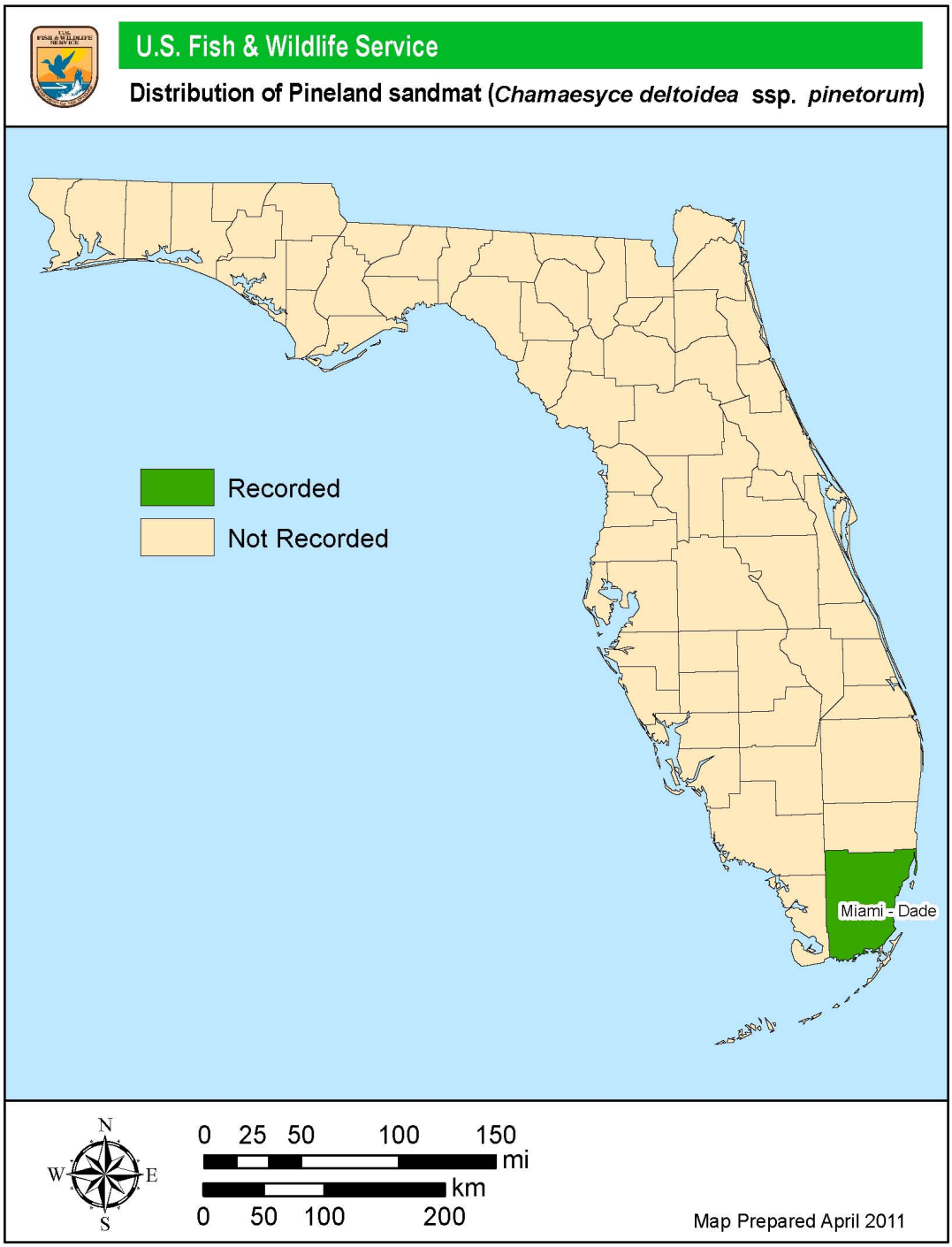
Bradley and Gann (1999, p. 25) provided the following description, “This species occurs in pine rockland in pockets of clayey marl or on oolitic limestone. The soils on which it occurs outside of Everglades National Park are classified as Opalocka rock-outcrop soils (soils within the National Park have not been classified) (USDA 1996). The pine rocklands where this plant occurs are at the southern end of the Miami Rock Ridge and are at lower elevations than most pine rockland areas to the north. This is especially true for the pine rocklands on Long Pine Key, which flood occasionally. Fire is an important element in maintaining the pine

rockland habitat. Periodic fires eliminate the shrub subcanopy and remove litter from the ground." Jimi Sadle (pers. comm. 2010), botanist at Everglades National Park (ENP), indicates that pineland sandmat occurs in higher pine rockland areas of Long Pine Key that do not flood. Pineland sandmat is shade intolerant and requires periodic burning to reduce competition from woody vegetation. Without fire, native hammock species and exotics invade pine rocklands changing their structure and function (Wendelberger 2003, p. 182).

Pineland sandmat occurs in pine rocklands characterized by a canopy of Pinus elliottii var. densa (southern slash pine), a shrub canopy of Serenoa repens (saw palmetto), Myrica cerifera (wax myrtle), Metopium toxiferum (poisonwood), and Sideroxylon salicifolium (willow bustic) (Bradley and Gann 1999, p. 25). Common herbaceous associates include: Schizachyrium sanguineum (crimson bluestem), Schizachyrium gracile (wire bluestem), Aster adnatus (scaleleaf aster), and Acalypha chamaedrifolia (bastard copperleaf) (Bradley and Gann 1999, p. 25). Pineland sandmat is often associated with other rare plant taxa, including Argythamnia blodgettii (Blodgett's silverbush) and Brickellia mosieri (Florida brickell-bush) (Bradley and Gann 1999, p. 25).

Historical Range/Distribution:

"C. deltoidea ssp. pinetorum was historically known from only the southern portions of the Miami Rock Ridge in southern Miami-Dade County. The northernmost occurrences were found at SW 296 St. (latitude ca. 25° 29.52') and possibly as far north as SW 248 St. (latitude ca. 25° 32.14'). It extended south through Long Pine Key in Everglades National Park." (Bradley and Gann 1999, p. 24). One purported locality may have been reported inaccurately. A specimen collected by Burch (No. 232, NYBG) in 1963 at the intersection of S.W. 187 Avenue and 248 Street had a label describing the station as 'Princeton'. (Bradley and Gann 1999, p. 24). However, this intersection is more than 5 miles (8.0 kilometers) west of the area known as Princeton and 3 miles (4.8 kilometers) north of the northernmost confirmed station for this taxon (Bradley and Gann 1999, p. 24).



Current Range Distribution:

The current range is similar to the historical range, although most of the former habitat outside of ENP has been lost and only small remnants remain. The area outside of ENP represents nearly half of the range (Bradley and Gann 1999, p. 25). Based upon Bradley and Gann (1999, p. 28) and data from The Institute for Regional Conservation (IRC) (Gann et al. 2008, p. 1; K. Bradley, IRC, pers. comm. 2007) and data from ENP (J. Sadle, pers. comm. 2011), this plant is extant at the sites in Table 1. However, in a recent survey of Larry and Penny Thompson Park, no individuals were found (J. Possley, FTBG, pers. comm. 2011).1

Table 1. Extant occurrences of pineland sandmat

Site	Owner	Population Size	Threats
ENP	NPS	10,000-100,000	hydrologic changes (possible), exotic plants
Florida City Pineland	Miami-Dade County	100-1,000	exotic plants, fire suppression
Navy Wells	Miami-Dade County	1,000-10,000	exotic plants, fire suppression
Navy Wells #2	Miami-Dade School Board	1,000-10,000	exotic plants, development, fire suppression
Palm Drive Pineland	Miami-Dade County	10-100	exotic plants, fire suppression
Pine Ridge Sanctuary	Private Preserve	10-100	exotic plants, fire suppression
Rock Pit #39	Miami-Dade County	11-100	exotic plants, fire suppression
Seminole Wayside Park	Miami-Dade County	100-1,000	exotic plants, fire suppression
Fuchs Hammock Addition	Miami-Dade County	11-100	exotic plants, fire suppression
Navy Wells Pineland #39	Miami-Dade County	100-1,000	exotic plants, fire suppression
Sunny Palms Pineland	Miami-Dade County	100-1,000	exotic plants, fire suppression
Larry and Penny Thompson Park	Miami-Dade County	0	not assessed
John Kunkel Small Pineland	IRC	not assessed	not assessed
Natural Forest Community [NFC] #P330	private	11-100	development, exotic plants, fire suppression
NFC #P338	private	1,001-10,000	development, exotic plants, fire suppression
NFC #P339	private	11-100	development, exotic plants, fire suppression
NFC #P347	private	11-100	development, exotic plants, fire suppression
NFC #P411	private	101-1,000	development, exotic plants, fire suppression
NFC #P413	private	11-100	development, exotic plants, fire suppression
NFC #P416	private	11-100	development, exotic plants, fire suppression
NFC #P445	private	1,001-10,000	development, exotic plants, fire suppression

The species was also not found during a 2-year project intended to survey and map exotic and rare plants along Florida Department of Transportation (FDOT) right-of-ways within Miami-Dade County (Gordon et al. 2007, pp. 1, 36).

Population Estimates/Status:

The total population size is estimated to be between 14,500 to 146,000 individuals (See Table 1). Bradley and Gann (1999, p. 25) indicated that the population of the pineland sandmat was probably declining due to threats. However, since that time, several additional occurrences have been found.

The rounded global status of pineland sandmat is considered to be T1, critically imperiled (NatureServe 2010, p. 1). NatureServe (2010, p. 1) indicates that this species has a limited distribution and is “threatened by fire suppression, alteration of the fire regime and non-native plant invasions”. The Florida Natural Areas Inventory (FNAI 2011, p. 2) considers its global status to be G2T1, subspecies “critically imperiled globally” (and the entire species as “imperiled globally”). Gann et al. (2001-2010, p. 1) indicates that its status is rare. This species is listed as endangered by the State.

Threats

A. The present or threatened destruction, modification, or curtailment of its habitat or

range:

The Miami-Dade County pine rocklands have largely been destroyed by residential, commercial, and urban development and agriculture. Pine rocklands in the County (including patches of marl prairie) have been reduced to about 11 percent of their former extent (Kernan and Bradley 1996, p. 2). Of the estimated historical extent of 182,780 acres (74,000 hectares [ha]), only 20,106 acres (8,140 ha) of pine rocklands remained in 1996. Outside of ENP, only about 1 percent of the Miami Pine Rock Ridge pinelands remain and much of what is left is in small remaining blocks isolated from other natural areas (Herndon 1998, p. 1). Most of the pine rocklands from the plant's northernmost occurrence south to ENP have been developed and this area contains few remaining occurrences (Bradley and Gann 1999, pp. 24-25). The area outside of ENP represents nearly half of the range of this taxon (Bradley and Gann 1999, p. 25).

Pinelands were mapped for Miami-Dade County's geographic information system in 2004. The data confirm the limited extent of remaining pine rocklands outside of ENP and document severe losses of privately-owned pinelands over the past decade. Even some publicly-owned pinelands where this species occurs are vulnerable to development. The largest site outside of ENP is 346 acres (140 ha) and all other sites are less than 20 acres (8 ha) (Bradley and Gann 1999, p. 25). Most private lands where this species occurs are either not being managed for this species or are being developed (Bradley and Gann 1999, p. 25). An estimated 9 of 20 sites where this plant occurs are at risk of development (Gann et al. 2008, p. 1; K. Bradley, pers. comm. 2007).

The largest population in ENP is essentially protected from development or agriculture, which could result in habitat loss. Hydrological changes and other natural and anthropogenic factors may still affect this species despite its protection on public conservation lands (see Factor E).

Habitat loss continues to occur in this species' range, and most remaining suitable habitat has been negatively altered by human activity. Miami-Dade County has developed a network of small public conservation lands and has encouraged conservation of natural vegetation on private land. The County's actions may have averted extirpation of this and other pineland plants. As a result, some opportunities exist to conserve this plant on private land, but there is little opportunity to acquire more conservation lands. Conservation of privately-owned pine rocklands in Miami-Dade County is largely a matter of county government cooperation with private landowners and the county offers incentives for landowners to maintain their natural forest communities (NFCs).

Threats from on-going urban development will continue where the species and its habitat occur on private lands. The human population within Miami-Dade County, which supports the entire range of this species, is currently greater than 2.4 million people, and the population is expected to grow to more than 4 million by 2060, an annual increase of roughly 30,000 people (Zwick and Carr 2006, p. 20). Therefore, nearly all occurrences of pineland sandmat on private land are at risk to development, and this threat is expected to continue.

Climatic changes, including sea level rise, are major threats to south Florida, including this species and its habitat. The Intergovernmental Panel on Climate Change (IPCC) reported that the warming of the world's climate system is unequivocal based on documented increases in global average air and ocean temperatures, unprecedented melting of snow and ice, and rising average sea level (IPCC 2007, p. 2; 2008, p. 15). Sea-level rise is the largest climate-driven challenge to low-lying coastal areas and refuges in the sub-tropical ecoregion of southern Florida (U.S. Climate Change Science Program [CCSP] 2008, pp. 5-31, 5-32).

IPCC (2008, p. 28) emphasized it is very likely that the average rate of sea-level rise during the 21st century will exceed that from 1961 to 2003 (i.e., 0.071 inches [0.18 cm] per year), although it was projected to have substantial geographical variability. Partial loss of the Greenland and/or Antarctic ice sheets could result in many feet (several meters) of sea-level rise, major changes in coastlines, and inundation of low-lying areas (IPCC 2008, pp. 28-29). Low-lying islands and river deltas will incur the largest impacts (IPCC 2008, pp.

28-29). Because dynamic ice flow processes in ice sheets are poorly understood, timeframes are not known; however, modeling indicates that "more rapid sea-level rise on century timescales cannot be excluded" (IPCC 2008, pp. 29). According to CCSP (2008, p. 5-31), much of low-lying, coastal south Florida "will be underwater or inundated with salt water in the coming century".

IPCC (2008, pp. 3, 103) concluded that "climate change is likely to increase the occurrence of saltwater intrusion into coastal aquifers as sea level rises" and that, "sea-level rise is projected to extend areas of salinisation of groundwater and estuaries, resulting in a decrease of freshwater availability for humans and ecosystems in coastal areas." From the 1930s to 1950s, increased salinity of coastal waters contributed to the decline of cabbage palm forests in southwest Florida (Williams et al. 1999, pp. 2056-2059), and expansion of mangroves into adjacent marshes in the Everglades (Ross et al. 2000, pp. 9, 12-13). Hydrology has a strong influence on plant distribution in these and other coastal areas (IPCC 2008, p. 57). Such communities typically grade from salt to brackish to freshwater species. Human developments will also likely be significant factors influencing whether natural communities can move and persist (IPCC 2008, p. 57; CCSP 2008, p. 7-6).

The Science and Technology Committee of the Miami-Dade County Climate Change Task Force (MDCCCTF) (2008, p. 1) recognized that significant sea level rise is a very real threat to the near future for Miami-Dade County. In a January 2008 statement, the MDCCCTF (2008, pp. 2-3) warned that sea-level is expected to rise at least 3-5 feet (0.9 – 1.5 m) within this century. With a 3-4 foot (0.9 – 1.2 m) rise in sea level (above baseline) in Miami-Dade County: "Spring high tides would be at about + 6 to 7 feet; freshwater resources would be gone; the Everglades would be inundated on the west side of Miami-Dade County; the barrier islands would be largely inundated; storm surges would be devastating; landfill sites would be exposed to erosion contaminating marine and coastal environments. Freshwater and coastal mangrove wetlands will not keep up with or offset sea level rises of two feet per century or greater. With a five foot rise (spring tides at nearly +8 feet), Miami-Dade County will be extremely diminished." (MDCCCTF 2008, pp. 2-3).

In summary, all known occurrences are at some risk to habitat loss and modification. Nearly all extant occurrences on private land are threatened by development. Most occurrences are in low-lying areas and will be affected by rising sea level. Overall threat level of habitat loss from development is moderate, since many sites are protected. Overall threat level of habitat loss from sea-level rise is currently low, but expected to become severe in the future.

B. Overutilization for commercial, recreational, scientific, or educational purposes:

Not known

C. Disease or predation:

Not known

D. The inadequacy of existing regulatory mechanisms:

FDACS designated Chamaesyce deltoidea, consisting of four subspecies, including ssp. pinetorum, as endangered under Chapter 5B-40, Florida Administrative Code. This listing provides little or no habitat protection beyond the State's Development of Regional Impact process, which discloses project impacts, but provides no regulatory protection for State-listed plants on private lands. Without local or county ordinances preventing the destruction of the plant, conservation does not occur. Where this species occurs on public conservation lands, existing regulatory mechanisms of those management agencies may be considered adequate.

E. Other natural or manmade factors affecting its continued existence:

At least 277 taxa of exotic plants have invaded pine rocklands throughout south Florida (Service 1999, p. 3-175). Invasive exotic species, especially Schinus terebinthifolius (Brazilian pepper) and Neyraudia reynaudiana (Burmareed), threaten the pineland sandmat on public and private lands (Bradley and Gann 1999, p. 25). Other invasive exotics such as Lygodium microphyllum (Old World climbing fern) and Melaleuca quinquenervia (melaleuca) are also a concern. Invasive exotic species are expected to continue to decrease the quality of the pine rocklands where this taxon occurs (Bradley and Gann 1999, p. 25).

In a recent study to better understand the location and extent of invasive exotic plants and rare native plants along roadways in Miami-Dade and Monroe Counties, 88 of 121 (73 percent) total target exotic plant species were found in at least one road segment (Gordon et al. 2007, p. 10). Of the 16,412 road segments surveyed, 6,264 (38 percent) contained at least one exotic plant species; some segments contained more than one species of invasive exotic plant (and as many as 15) (Gordon et al. 2007, pp. 10-11). In Miami-Dade County, the most frequent naturalized invasive exotic plants recorded were Brazilian-pepper, Tribulus cistoides (punctureweed), and Pennisetum purpureum (napier grass) (Gordon et al. 2007, p. 11).

The NPS acknowledges Brazilian pepper as an aggressive invader that is widespread throughout pinelands fire management unit 3 in ENP (NPS 2005, p. 30). However, this species has generally been managed on the NPS land in undisturbed sites by prescribed fire (NPS 2005, p. 30) reducing the threat at this time. Imperata cylindrica (Cogon grass) and Burmareed have also been observed and treated in the Boy Scout Camp and along the eastern boundary at ENP (NPS 2005, p. 30). The NPS believes that both could expand into the pinelands and may become problematic because of their fire adaptations (NPS 2005, p. 30). In addition, Old World climbing fern is spreading toward Long Pine Key in ENP. However, at this time, the overall threat of exotics to pineland sandmat at ENP appears to be under control due to prescribed fire at ENP. It is not known if this problem will intensify or if the NPS will have the resources to continue its efforts in combating exotics within ENP.

Bradley and Gann (1999, pp. 25-26) indicated that the management of pine rocklands outside of ENP is complicated because remaining habitat occurs in small fragments bordered by urban development. These areas that surround managed lands often contain exotics and can act as seed sources allowing exotics to continue to invade the pine rockland. The mapping project in Miami-Dade County, conducted in 2004, also showed that exotics encroach on pinelands, especially around the edges. Continual maintenance is often needed.

Fire suppression is a threat to pineland sandmat (Bradley and Gann 1999, pp. 25-26). Fire maintains the pine rockland community. Under natural conditions, lightning fires typically occurred at 3 to 7- year intervals, or more frequently in marl prairies. With fire suppression, hardwoods eventually invade pine rocklands and shade out understory species like pineland sandmat. Fire suppression outside of ENP has reduced the size of the areas that do burn and habitat fragmentation has prevented fire from moving across the landscape in a natural way. Thus, many pine rockland communities are becoming tropical hardwood hammocks. While application of prescribed fire is difficult in the urban pine rockland fragments in Miami-Dade County, it is somewhat easier to apply on larger public conservation lands. Fire is a necessary component of the pine rockland ecosystem, and prescribed fire is actively being used at ENP.

Invasive exotic plant species also alter the type of fire that occurs in pine rocklands. Historically, pine rocklands had an open, low understory where natural fires remained patchy with low temperature intensity, thus sparing many native plants such as the pineland sandmat. Dense exotic plant overgrowth may no longer allow the species to be conserved through prescribed burning. Dense growth can create higher fire temperatures and longer burning periods than pine rockland plants can tolerate. Under current conditions, exotic plant control may require alternate, more labor intensive methods such as hand chopping followed by spot herbicide treatment, which is costly. Given the acreage of land, staffing, and budget constraints, this method may not be feasible in all sites.

Bradley (pers. comm. 2005) commented that mechanical treatment (e.g., hand-held power tools) is often required prior to applying prescribed fire. With too much growth of Burmareed and Brazilian pepper, it is often not possible to conduct a safe burn because it will be too hot. Native hardwoods, like exotics, regularly encroach on pinelands, and if burned can also cause a hot, destructive fire. Mechanical treatments cannot entirely replace fire because in the absence of fire, pine trees, understory shrubs, grasses, and herbs all contribute to an ever-increasing duff layer. Duff will accumulate even if hardwoods are mechanically removed. When the duff becomes thick, it covers herbs and prevents most seeds from germinating. In addition to removing duff, fires leave ashes that provides important nutrient cycling, which is lost with mechanical removal. Overall, mechanical treatments to remove native hardwoods and/or exotic plants from pine rocklands help restore the vegetation, especially when used in combination with prescribed fire.

Hydrology is a key ecosystem component that affects rare plant distributions and their viability (Gann et al. 2006, p. 4). Historically, sheet flow from Shark River Slough and Taylor Slough did not reach the upland portions of Long Pine Key, but during the wet season increased surface water flow in sloughs generated a rise in ground water across the region (Gann et al. 2006, p. 4). As artificial drainage became more widespread, however, regional groundwater supplies declined. Historical patterns of water flow through Long Pine Key are further confounded by road construction (Gann et al. 2006, p. 4). Water flow through Long Pine Key was originally concentrated in marl prairies, traversing in a north-south direction; however, construction of the main ENP road dissected Long Pine Key in an east-west direction, thereby impeding sheet flow across this area (Gann et al. 2006, p. 4). Water was either impounded to the north of the main ENP road or diverted around the southern portion of Long Pine Key through Taylor Slough and Shark River Slough (Gann et al. 2006, p. 4). Research Road may similarly affect the water supply of the southern portions of Long Pine Key (Gann et al. 2006, p. 4).

Gann et al. (2006, p. 2) and Herndon (1998, p. 2) expressed concern that changes to regional water management intended to restore the Everglades could negatively affect the pinelands of Long Pine Key. Gann et al. (2006, p. 5) stated that if hydrological restoration is successful, ground water levels will presumably be raised, wet season flows will return to marl prairies and fire intensities will decrease, and growing conditions for rare pineland and hammock plants will improve. Alternatively, implementation of the Comprehensive Everglades Restoration Plan may also lead to further impoundment of water north of the main park road, possible flooding of rare plant populations, and a failure to provide relief to habitats on Long Pine Key that are compartmentalized (by the main ENP road and Research Road) and have been impacted from long-term drainage (Gann et al. 2006, p. 5). Sadle (pers. comm. 2010), however, believes that the threat of hydrologic changes may be overstated since this plant occurs at higher areas within ENP. At this time, it is not known whether the proposed restoration and associated hydrological modifications will have a positive or negative impact on various rare species within ENP (Gann et al. 2006, p. 2).

Given the species' narrow range, pineland sandmat may be vulnerable to catastrophic events and natural disturbances, such as hurricanes. Hurricanes have impacted Miami-Dade County in the recent past (e.g., Hurricane Andrew). Three hurricanes hit south Florida in 2005 (Katrina, Rita, and Wilma). According to the National Oceanographic and Atmospheric Administration, Miami-Dade County, the Keys, and western Cuba are the most storm-prone areas in the Caribbean. The threat of future hurricanes and tropical storms is expected to continue.

In summary, pineland sandmat is vulnerable to a wide array of natural and human factors, including: small and isolated occurrences, restricted range, fire suppression, invasive exotic plants, human land use intensification (from natural areas to agricultural and urban uses), regional water management changes, road developments that alter water flow, as well as catastrophic events and natural disturbances, like hurricanes and extreme weather events.

Conservation Measures Planned or Implemented :

Public lands with pineland sandmat are primarily managed by Miami-Dade County and NPS. Both entities have worked to control exotic plants with available resources. ENP has effectively controlled exotic plants at Long Pine Key with prescribed fire; however, it is not known if resources will be available in the future to continue this effort.

Everglades restoration will consider the protection of the uplands of Long Pine Key as water flow into the surrounding Everglades wetlands is restored. Through the Critical Ecosystems Study Initiative, a 5-year study was funded to: survey and map the 30 rare species identified in Gann et al. (2002, p. 1-1056), establish a long-term monitoring program to evaluate population responses of these species to Everglades restoration, and augment or reintroduce populations of select species if warranted (Gann et al. 2006, p. 2). Although pineland sandmat is not included, other rare plant data from this study may be useful in that the study area includes Long Pine Key, which supports the largest population of pineland sandmat.

Overall, fire management is being conducted effectively for this species in ENP. It is not known if the NPS will have the resources to continue this in the future or be able to monitor the population through time.

In 1979, Miami-Dade County enacted the Environmentally Endangered Lands Covenant Program, which reduces taxes for private landowners of pine rocklands and tropical hardwood hammocks who agree to not develop their property and manage it for a period of 10 years (Service 1999, p. 3-177). Miami-Dade County also purchases NFCs, including tropical hammocks and pine rocklands.

The Miami-Dade Forest Resources Program has regulatory authority over pine rocklands and tropical hardwood hammocks and is charged with enforcing regulations that provide partial protection on the Miami Rock Ridge (Service 1999, p. 3-177). This includes authority over all NFCs in the County, including County- and city-owned parcels (Service 1999, p. 3-177).

In cooperation with the Service and IRC, Miami-Dade County funded a project to map the existing NFCs and inventory rare and sensitive plants species on these lands. This project has been completed.

In 2005, the Service funded IRC through the Private Stewardship Grant Program to facilitate restoration and management of privately-owned pine rockland habitats in Miami-Dade County. Restoration efforts include exotic plant control, light debris removal, hardwood management, and reintroduction of pines. Management plans include recommendations for prescribed burning, debris cleanup, exotic animal control, and hydrological restoration. This project is largely completed.

In 2007, the Service funded IRC to implement conservation activities associated with three other candidate plant species on pine rockland fragments in Miami-Dade County in private ownership. The objective of this project is to restore suitable habitat and reintroduce and establish new populations of the plants in pine rocklands. Although pineland sandmat was not targeted in the original project, the Service has since expanded its partnership with IRC. In 2009, IRC successfully conducted its first prescribed fires, burning two IRC-owned sites (K. Bradley, pers. comm. 2009; Bradley 2010, p. 3). In addition to being major successes ecologically, the burns helped build experience and relationships with partner agencies (Bradley 2010, p. 3).

In October 2010, the Service funded IRC to conduct 6 to 12 additional prescribed burns on private and public lands to assist in the conservation and recovery of federally endangered plants and Federal candidate animals and plants, including pineland sandmat (Bradley 2010, pp. 1-10). Planning is underway; prescribed fires have not yet been conducted.

The Service’s Coastal and Partners for Fish and Wildlife Programs are also pursuing similar pine rockland restoration projects in Miami-Dade County, which could help improve the status of the species. In 2009, $400,000 of stimulus funding was allocated for habitat restoration in Miami-Dade County through the Coastal program as part of the Pine Rockland Initiative (D. DeVore, Service, pers. comm. 2010).

FTBG has collected 130 seeds from 35 maternal lines at two of seven ENP locations, but more collections need to be made from all seven sites (Wendelberger and Maschinski 2006, p. 2). All seeds collected to date have been sent to the National Center for Genetic Resources Preservation for storage (Wendelberger and Maschinski 2006, p. 2).

The FDOT collaborated on and funded a study of the approximately 650 miles (1,046 kilometers) of FDOT roadway in Miami-Dade and Monroe counties (District 6) (Gordon et al. 2007, pp. 1, 3). The study was conducted by The University of Florida, in collaboration with IRC and the FNAI to survey and map exotic and rare native plants along FDOT right-of-ways within Miami-Dade and Monroe counties. Although this species was not found during this study, this effort created a database that can be updated to reflect future activities and conditions (Gordon et al. 2007, pp. 1, 3), should the species re-establish itself in these areas.

Summary of Threats :

At its remaining locations, the pineland sandmat and its habitat are vulnerable to a variety of human and natural factors. The species' habitat, pine rocklands, is globally imperiled and dependent upon fire. Plants on private (non-conservation) land and one County-owned parcel remain at risk to habitat loss, degradation, and fragmentation from development. Climatic changes, including sea level rise, are long-term threats that will continue; these factors are expected to continue to impact pine rocklands and ultimately reduce the extent of available habitat. Pineland sandmat is threatened by habitat loss and habitat degradation due to fire suppression, the difficulty of applying prescribed fire, and exotic plants. These threats are severe within small and unmanaged fragments in urban areas. However, the largest population occurs on lands managed by NPS where the threats of fire suppression and exotics are reduced. Hydrology has been altered within Long Pine Key at ENP due to artificial drainage, which lowered ground water, and construction of roads, which either impounded or diverted water. Regional water management intended to restore the Everglades could negatively affect the pinelands of Long Pine Key. Hydrologic restoration could improve conditions for pineland plants; however, components of Everglades restoration may also negatively affect species. At this time, it is not known whether the proposed restoration and associated hydrological modifications will have a positive or negative effect on pineland sandmat. This narrow endemic may be vulnerable to catastrophic events and natural disturbances, such as hurricanes. We find that this species is warranted for listing throughout all of its range, and, therefore, find that it is unnecessary to analyze whether it is threatened or endangered in a significant portion of its range.

For species that are being removed from candidate status:

_____ Is the removal based in whole or in part on one or more individual conservation efforts that you determined met the standards in the Policy for Evaluation of Conservation Efforts When Making Listing Decisions(PECE)?

Recommended Conservation Measures :

• Conserve pine rocklands and suitable habitat through purchase or conservation easements (Wendelberger 2003, p. 182).
• Remove exotic plants or hardwoods. Use manual labor, herbicides, and prescribed fire, and once cleared, use proper management to reduce costs of control and to maintain the site free of exotics (Bradley and Gann 1999, p 26.). Control seed sources in small, fragmented areas surrounded by urban development (Bradley and Gann 1999, p. 26).
• Implement regular, prescribed burns to create or maintain suitable habitat conditions. In general, a mosaic of burns should be used, and the recommended burning regime is 3 to 7 years with summer burns generally preferred to winter burns (Bradley and Gann 1999, p. 26). Where fire has been suppressed for long periods of time, reintroduce fire in a step-wise manner (Bradley and Gann 1999, p. 26; Wendelberger 2003, p. 182). Include a monitoring program to determine effectiveness of the fire prescription (Bradley and Gann 1999, p.

26).
• Monitor and manage pine rockland fragments in Miami-Dade County.
• Continue monitoring rare plants at Long Pine Key (Gann et al. 2006, p. 2). It is important to determine effects (positive or negative) from Everglades restoration and other hydrologic manipulations and changes.
• Resurvey known locations and compare those data with current location data to better understand the stability and size of the population (Wendelberger 2003, p. 183; Maschinski et al. 2005, p. 163).
• Consider ex situ collections (Maschinski et al. 2005, p. 163).
• Assess the need for studies to determine current level of genetic variation remaining in extant occurrences.
• Assess the need to augment the population (Wendelberger 2003, p. 183).

Priority Table

Magnitude	Immediacy	Taxonmomy	Priority
High	Imminent	Monotypic genus	1
		Species	2
		Subspecies/Population	3
	Non-imminent	Monotypic genus	4
		Species	5
		Subspecies/Population	6
Moderate to Low	Imminent	Monotype genus	7
		Species	8
		Subspecies/Population	9
	Non-imminent	Monotypic genus	10
		Species	11
		Subspecies/Population	**12**

Rationale for Change in Listing Priority Number:

Magnitude:

One County-owned and nearly all privately-owned pine rockland sites supporting this plant are at risk to development, but occupied habitats within ENP and other County-owned lands are, for the most part, protected. We consider this threat to be moderate. Climatic changes, including sea level rise, are long-term threats that will reduce the extent of habitat. Overall threat level of habitat loss from sea-level rise is currently low, but expected to become severe in the future. This species is threatened by habitat loss and habitat degradation due to fire suppression, the difficulty of applying prescribed fire, and threats from exotic plants; however, efforts are underway to combat these threats to a certain extent on conservation lands. We consider these threats to be moderate. Historically, hydrologic alteration has impacted Long Pine Key, the site of this plant's largest population. The effects of various Everglades restoration projects in the future are unknown. The pineland sandmat may be vulnerable to catastrophic events and natural disturbances, such as hurricanes. This threat is considered to be low since a large occurrence exists at ENP and several other occurrences exist at other locations. Overall, the magnitude of threats is considered to be moderate.

Imminence :

One County-owned and nearly all privately-owned pine rockland sites supporting this plant are threatened with habitat loss due to development; this threat is considered imminent. However, the largest occurrence of pineland sandmat is located within ENP, and eight others occur on County lands. Therefore, the threat of habitat loss from development at these sites is considered non-imminent. Sea level rise is currently occurring and has resulted in the loss of pine rocklands. However, this is considered a long-term threat since we do not have evidence that it is currently affecting any population. The threat presented by currently present exotic plants place constant pressure on the pineland habitat and has the potential to change the fire regime. However, efforts are underway to combat this issue on many conservation lands. The threat from exotics outside of ENP is considered imminent and more difficult to address, but due to the current management practices within the ENP, the threat to the largest population is considered non-imminent. Hydrologic alterations have impacted Long Pine Key in the past. Planned Everglades restoration and associated hydrologic changes will likely affect this species in the future, but those effects are considered unknown and non-imminent. Threats from hurricanes are considered non-imminent due to population size and multiple occurrences. Overall, the majority of threats are non-imminent.

__Yes__ Have you promptly reviewed all of the information received regarding the species for the purpose of determination whether emergency listing is needed?

Emergency Listing Review

__No__ Is Emergency Listing Warranted?

This plant persists on several conservation lands. With proper management, many threats to this species can be removed or reduced.

Description of Monitoring:

Although ENP is not formally monitoring this species, it is sponsoring a project to assemble historical data on species' occurrences and to conduct field work on a broad array of imperiled plant species.

The Service completed a project with IRC and Miami-Dade County to map public and many private natural forest communities for the County's geographic information system. This project provided a list of plant species for each site. The project will enable the County to manage information on pinelands and detect changes in their extent.

FTBG and Miami-Dade County are working on a fire monitoring protocol for Miami-Dade County Preserves (J. Maguire, Miami-Dade County, pers. comm. 2008). The draft protocol suggests three levels of monitoring, focusing on rare species, vegetation structure, and diversity (Possley and Maschinski 2007, p. 4). The Chamaesyce deltoidea complex is one of several indicators to be used in the monitoring transects. FTBG has observed pineland sandmat at ENP, but currently does not have any population numbers or a good assessment for the health of that population (J. Maschinski, FTBG, pers. comm. 2007).

Indicate which State(s) (within the range of the species) provided information or comments on the species or latest species assessment:

none

Indicate which State(s) did not provide any information or comment:

Florida

State Coordination:

Florida Department of Agriculture and Consumer Services, National Park Service, Service (National Wildlife Refuges), Florida Department of Environmental Protection, Miami-Dade County, Florida Fish and Wildlife Commission, FNAI, IRC, Historic Bok Sanctuary, The Nature Conservancy, FTBG, Archbold Biological Station, NatureServe, University of Central Florida, Florida International University, University of Florida, Princeton, members of the Rare Plant Task Force, botanists, and others. In total, the previous assessment was sent to approximately 200 individuals. Limited new information was provided. All new information and comments have been incorporated.

The State of Florida does not include plants in their State Wildlife Action Plan.

No new data or comments were received from the State for this assessment. Information and data previously provided have been incorporated into this assessment.

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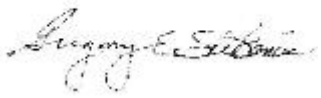
Approval/Concurrence:

Lead Regions must obtain written concurrence from all other Regions within the range of the species before recommending changes, including elevations or removals from candidate status and listing priority changes; the Regional Director must approve all such recommendations. The Director must concur on all resubmitted 12-month petition findings, additions or removal of species from candidate status, and listing priority changes.

Approve:  06/22/2011
Date

Concur:  10/07/2011
Date

Did not concur: _____ _____
Date

Director's Remarks: